

This listing of claims will replace all prior versions, and listings, of claims in the application:

1 Claim 1 (currently amended): A solid-state imaging device
2 comprising:
3 a pixel unit constituted by a two-dimensional array of
4 pixels for generating charge in correspondence to received
5 light and accumulating the charge for a predetermined
6 period of time;
7 a vertical transfer unit for vertically transferring
8 charge from the pixels in the pixel unit, a horizontal
9 transfer unit for horizontally transferring charge from the
10 vertical transfer unit;
11 shift gates each provided between each pixel and the
12 vertical transfer unit for reading out the charge in the
13 pixels to the vertical transfer unit, gate electrodes for
14 controlling the shift gates; and
15 a plurality of lead lines for connecting the gate
16 electrodes to an external circuit and a plurality of
17 connection terminals for connecting the gate electrodes to
18 the external circuit,
19 the gate electrodes making up N of gate electrode
20 groups in which the lines belonging to each coset of
21 modulo N within successive pixel rows are connected to
22 common lead lines, N being a predetermined natural number
23 between 4 and one half the number of pixels in a column,
24 and N also being the minimum periodic unit of connections
25 from said gate electrodes to said connection terminals
26 within said successive pixel rows, the gate electrodes
27 having common connection terminals to
28 (i) reduce the number of the connection terminals to
29 less than N, and

30 (ii) enable the gate electrodes having common
31 connection terminals to be controlled with different
32 timing from the timing of non-common connection
33 terminals of the gate electrode groups.

1 Claim 2 (currently amended): A solid-state imaging device
2 comprising:
3 a pixel unit constituted by a two-dimensional array of
4 pixels for generating charge in correspondence to received
5 light and accumulating the charge for a predetermined
6 period of time;
7 a vertical transfer unit for vertically transferring
8 charge from the pixels in the pixel unit, a horizontal
9 transfer unit for horizontally transferring charge from the
10 vertical transfer unit;
11 shift gates each provided between each pixel and the
12 vertical transfer unit for reading out the charge in the
13 pixels to the vertical transfer unit, gate electrodes for
14 controlling the shift gates; and
15 a plurality of lead lines for connecting the gate
16 electrodes to an external circuit and a plurality of
17 connection terminals for connecting the gate electrodes to
18 the external circuit,
19 gate control lines connected to gate electrode groups
20 in which horizontal lines belonging to each coset of modulo
21 N within successive pixel rows are connected commonly, N
22 being a predetermined natural number between 4 and one half
23 the number of pixels in a column, and \underline{N} also being the
24 minimum periodic unit of connections from said gate
25 electrodes to said connection terminals within said
26 successive pixel rows, being combined with each other so as
27 to

28 (i) reduce the number of the connection terminals to
29 less than N, and
30 (ii) enable the gate electrodes having common
31 connection terminals to be controlled with different
32 timing from the timing of non-common connection
33 terminals of the gate electrode groups.

1 Claim 3 (currently amended): A solid-state imaging device
2 comprising:
3 a pixel unit constituted by a two-dimensional array of
4 pixels for generating charge in correspondence to received
5 light and accumulating the charge for a predetermined
6 period of time;
7 a vertical transfer unit for vertically transferring
8 charge from the pixels in the pixel unit, a horizontal
9 transfer unit for horizontally transferring charge from the
10 vertical transfer unit;
11 shift gates each provided between each pixel and the
12 vertical transfer unit for reading out the charge in the
13 pixels to the vertical transfer unit, gate electrodes for
14 controlling the shift gates; and
15 a plurality of lead lines for connecting the gate
16 electrodes to an external circuit and a plurality of
17 connection terminals for connecting the gate electrodes to
18 the external circuit,
19 the gate electrodes being provided in a predetermined
20 number N of gate electrode groups such that horizontal line
21 number of the gate electrode groups which are connected to
22 respective common lead lines belong to each same residue
23 class of modulo N, N being a predetermined natural number
24 between 4 and one half the number of pixels in a column,
25 and N also being the minimum periodic unit of connections

26 from said gate electrodes to said connection terminals
27 within said successive pixel rows, some of the gate
28 electrode groups being commonly connected
29 (i) so that the connection terminals are less in
30 number than N, and
31 (ii) to enable the gate electrodes having common
32 connection terminals to be controlled with different
33 timing from the timing of non-common connection
34 terminals of the gate electrode groups.

1 Claim 4 (currently amended): A solid-state imaging device
2 comprising:
3 a pixel unit constituted by a two-dimensional array of
4 pixels for generating charge in correspondence to received
5 light and accumulating the charge for a predetermined
6 period of time;
7 a vertical transfer unit for vertically transferring
8 charge from the pixels in the pixel unit, a horizontal
9 transfer unit for horizontally transferring charge from the
10 vertical transfer unit;
11 shift gates each provided between each pixel and the
12 vertical transfer unit for reading out the charge in the
13 pixels to the vertical transfer unit, gate electrodes for
14 controlling the shift gates; and
15 a plurality of lead lines for connecting the gate
16 electrodes to an external circuit and a plurality of
17 connection terminals for connecting the gate electrodes to
18 the external circuit,
19 the gate electrodes making up N of gate electrode
20 groups in which the lines belonging to each coset of modulo
21 N within successive pixel rows are connected to common lead
22 lines, N being a predetermined natural number between 4 and

23 one half the number of pixels in a column, and N also being
24 ~~a~~the minimum periodic unit of connections from said gate
25 electrodes to said connection terminals within said
26 successive pixel rows, the gate electrode groups having
27 common connections to

28 (i) reduce the number of the connection terminals to
29 less than N, and

30 (ii) enable the gate electrodes having common
31 connection terminals to be controlled with different
32 timing from the timing of non-common connection
33 terminals of the gate electrode groups,

34 wherein the commonly connected gate electrode groups
35 are always controlled in the same way in each of all
36 predetermined read-out modes including selective pixel
37 read-out modes by selective shift gate driving.

1 Claim 5 (currently amended): A solid-state imaging device
2 comprising:

3 a pixel unit constituted by a two-dimensional array of
4 pixels for generating charge in correspondence to received
5 light and accumulating the charge for a predetermined
6 period of time;

7 a vertical transfer unit for vertically transferring
8 charge from the pixels in the pixel unit, a horizontal
9 transfer unit for horizontally transferring charge from the
10 vertical transfer unit;

11 shift gates each provided between each pixel and the
12 vertical transfer unit for reading out the charge in the
13 pixels to the vertical transfer unit, gate electrodes for
14 controlling the shift gates; and

15 a plurality of lead lines for connecting the gate
16 electrodes to an external circuit and a plurality of

17 connection terminals for connecting the gate electrodes to
18 the external circuit,
19 gate control lines connected to gate electrode groups
20 in which the horizontal lines belonging to each coset of
21 modulo N within successive pixel rows are connected
22 commonly, N being a predetermined natural number between 4
23 and one half the number of pixels in a column, and N also
24 being the minimum periodic unit of connections from said
25 gate electrodes to said connection terminals within said
26 successive pixel rows, being combined with each other so as
27 to
28 (i) reduce the number of the connection terminals to
29 less than N, and
30 (ii) enable the gate electrodes having common
31 connection terminals to be controlled with different
32 timing from the timing of non-common connection
33 terminals of the gate electrode groups,
34 wherein the commonly connected gate electrode groups
35 are always controlled in the same way in each of all
36 predetermined read-out modes including selective pixel
37 read-out modes by selective shift gate driving.

1 Claim 6 (currently amended): A solid-state imaging device
2 comprising:
3 a pixel unit constituted by a two-dimensional array of
4 pixels for generating charge in correspondence to received
5 light and accumulating the charge for a predetermined
6 period of time;
7 a vertical transfer unit for vertically transferring
8 charge from the pixels in the pixel unit, a horizontal
9 transfer unit for horizontally transferring charge from the
10 vertical transfer unit;

11 shift gates each provided between each pixel and the
12 vertical transfer unit for reading out the charge in the
13 pixels to the vertical transfer unit, gate electrodes for
14 controlling the shift gates; and
15 a plurality of lead lines for connecting the gate
16 electrodes to an external circuit and a plurality of
17 connection terminals for connecting the gate electrodes to
18 the external circuit,
19 the gate electrodes being provided in a predetermined
20 number N of gate electrode groups such that horizontal line
21 number of the gate electrode groups which are connected to
22 respective common lead lines belong to each same residue
23 class of modulo N , N being a predetermined natural number
24 between 4 and one half the number of pixels in a column,
25 and N also being the minimum periodic unit of connections
26 from said gate electrodes to said connection terminals
27 within said successive pixel rows, some of the gate
28 electrode groups being commonly connected
29 (i) so that the connection terminals are less in
30 number than N , and
31 (ii) to enable the gate electrodes having common
32 connection terminals to be controlled with different
33 timing from the timing of non-common connection
34 terminals of the gate electrode groups,
35 wherein the commonly connected gate electrode groups
36 are always controlled in the same way in each of all
37 predetermined read-out modes including selective pixel
38 read-out modes by selective shift gate driving.

1 Claim 7 (previously presented): The solid-state imaging
2 device according to claim 4, wherein gate electrode groups
3 controlled in each of all the predetermined read-out modes

4 are set such as to provide a minimum number of connection
5 terminals for connecting the gate electrodes to an external
6 circuit.

1 Claim 8 (previously presented): The solid-state imaging
2 device according to claim 5 wherein gate electrode groups
3 controlled in each of all the predetermined read-out modes
4 are set such as to provide a minimum number of connection
5 terminals for connecting the gate electrodes to an external
6 circuit.

1 Claim 9 (previously presented): The solid-state imaging
2 device according to claim 6 wherein gate electrode groups
3 controlled in each of all the predetermined read-out modes
4 are set such as to provide a minimum number of connection
5 terminals for connecting the gate electrodes to an external
6 circuit.

Claims 10 and 11 (canceled)

1 Claim 12 (previously presented): The solid-state imaging
2 device of claim 1 wherein at least two horizontal lines
3 belonging to the same pixel group but to different gate
4 electrode groups are connected to a common connection
5 terminal.

1 Claim 13 (previously presented): The solid-state imaging
2 device of claim 2 wherein at least two horizontal lines
3 belonging to the same pixel group but to different gate
4 electrode groups are connected to a common connection
5 terminal.

1 Claim 14 (previously presented): The solid-state imaging
2 device of claim 3 wherein at least two horizontal lines
3 belonging to the same pixel group but to different gate
4 electrode groups are connected to a common connection
5 terminal.

1 Claim 15 (previously presented): The solid-state imaging
2 device of claim 4 wherein at least two horizontal lines
3 belonging to the same pixel group but to different gate
4 electrode groups are connected to a common connection
5 terminal.

1 Claim 16 (previously presented): The solid-state imaging
2 device of claim 5 wherein at least two horizontal lines
3 belonging to the same pixel group but to different gate
4 electrode groups are connected to a common connection
5 terminal.

1 Claim 17 (previously presented): The solid-state imaging
2 device of claim 6 wherein at least two horizontal lines
3 belonging to the same pixel group but to different gate
4 electrode groups are connected to a common connection
5 terminal.

1 Claim 18 (previously presented): The solid-state imaging
2 device of claim 1 wherein only two connection terminals
3 connected to said vertical transfer unit are not connected
4 to any of the gate electrodes.

1 Claim 19 (previously presented): The solid-state imaging
2 device of claim 2 wherein only two connection terminals
3 connected to said vertical transfer unit are not connected
4 to any of the gate electrodes.

1 Claim 20 (previously presented): The solid-state imaging
2 device of claim 3 wherein only two connection terminals
3 connected to said vertical transfer unit are not connected
4 to any of the gate electrodes.

1 Claim 21 (previously presented): The solid-state imaging
2 device of claim 4 wherein only two connection terminals
3 connected to said vertical transfer unit are not connected
4 to any of the gate electrodes.

1 Claim 22 (previously presented): The solid-state imaging
2 device of claim 5 wherein only two connection terminals
3 connected to said vertical transfer unit are not connected
4 to any of the gate electrodes.

1 Claim 23 (previously presented): The solid-state imaging
2 device of claim 6 wherein only two connection terminals
3 connected to said vertical transfer unit are not connected
4 to any of the gate electrodes.

1 Claim 24 (previously presented): The solid-state imaging
2 device of claim 1 wherein connections from said gate
3 electrodes to said connection terminals within successive
4 pixel rows have a periodic repetition, and wherein N is the
5 minimum period of repetition.

1 Claim 25 (previously presented): The solid-state imaging
2 device of claim 1 wherein connections from said gate
3 electrodes to said connection terminals within successive
4 pixel rows exhibit a repeating pattern, and wherein N is
5 the minimum period of the repeating pattern.